ALBERTA OIL SANDS INDUSTRY QUARTERLY UPDATE

SUMMER 2016

Reporting on the period:
March 11, 2016 to June 15, 2016

All about the oil sands

Background of an important global resource

Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada's 173 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 168 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 168 billion barrels of bitumen represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest-central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the "gum" to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

For the first time in 2012, in situ oil sands production exceeded mined oil sands production in Alberta. In 2014, 58 per cent of the province's oil sands volumes were produced using in situ methods. Alberta will continue to rely to a greater extent on in situ production in the future, as 80 per cent of the province's proven bitumen reserves are too deep under-ground to recover using mining methods.

There are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and the melted bitumen flows into the lower well via gravity and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The selection is based on a number of factors, including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or "upgraded," can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil, which is a refinery feedstock. That can be transformed into transportation fuels and other products. ■

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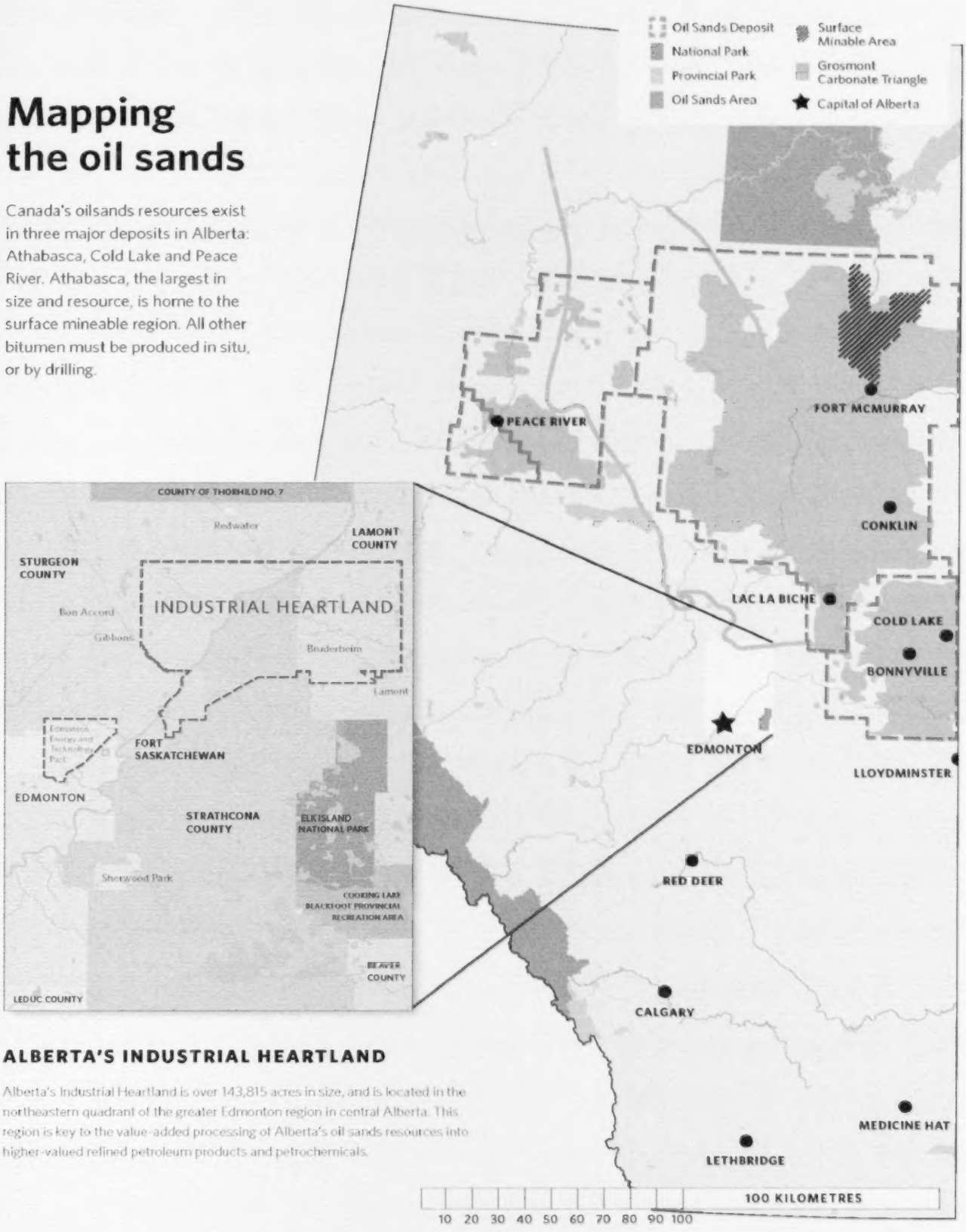
On the cover: An aerial shot of ConocoPhillips Canada's 118,000-bbl/d Surmont 2 SAGD project, which started producing bitumen in September. ConocoPhillips Canada

Mapping the oil sands

Canada's oilsands resources exist in three major deposits in Alberta: Athabasca, Cold Lake and Peace River. Athabasca, the largest in size and resource, is home to the surface mineable region. All other bitumen must be produced in situ, or by drilling.



ALBERTA'S INDUSTRIAL HEARTLAND

Alberta's Industrial Heartland is over 143,815 acres in size, and is located in the northeastern quadrant of the greater Edmonton region in central Alberta. This region is key to the value-added processing of Alberta's oil sands resources into higher-valued refined petroleum products and petrochemicals.

GOVERNMENT UPDATE | Alberta Government

FORT MCMURRAY WILDFIRE RESPONSE

On May 3, 2016, a massive wildfire in the Regional Municipality of Wood Buffalo threatened the Fort McMurray and surrounding communities, forcing the evacuation of nearly 90,000 residents. The fires destroyed about 2,400 buildings, or about 10 per cent of the city. The blaze ripped through the heart of oil sands country, devastating an area already hit hard by low oil prices.

The Government of Alberta declared a state of emergency on May 4. As the fire continued to spread, the communities of Anzac, Gregoire Lake Estates and Fort McMurray First Nation were also evacuated. Government distributed 45,885 wildfire relief debit cards to support refugees of the fires, totalling more than $92 million as of June 22. Financial relief for residents who evacuated out-of-province has reached $3.6 million.

As of June 1, with basic infrastructure restored and the fire no longer a threat, phased re-entry was allowed into the Fort McMurray region. Alberta Premier Rachel Notley said, "We have been clear that the health and safety of residents always comes first, and that we would not proceed with re-entry if it was not safe to do so."

A provincial donation strategy is in place to help displaced residents. On June 14, the Alberta government and the Regional Municipality of Wood Buffalo announced their partnership with ADRA Canada to co-ordinate the collection and distribution of donations for Fort McMurray residents following the wildfire. ADRA Canada will receive, sort, store, catalogue and distribute material donations.

The Government of Alberta and the Regional Municipality of Wood Buffalo have been working to ensure that Fort McMurray employers are given preference on recovery and rebuilding contracts. Of the 532 contracts signed by the Regional Emergency Operations Centre so far, about 80 per cent are with local employers from the Fort McMurray area.

Agriculture and Forestry is reviewing its response to the wildfire. The review will look at Agriculture and Forestry's wildfire preparation and readiness up to May 31 of this year and the steps taken to respond to fight the Fort McMurray wildfire.

In 2011, government initiated a review after wildfires burned into communities in the Slave Lake area. Twenty-one recommendations were produced from that review and all have been implemented or are continuing to be implemented.

During the fires, some of the largest oil sands producers in the province were forced to shut down.

"Recovering from a disaster is no small task," said Minister of Municipal Affairs Danielle Larivee, "but Fort McMurray residents are incredibly strong and resilient. They have shown tremendous strength in the face of this adversity, and our government will continue to stand with them as they resettle and recover. We have seen a great deal of progress in the past few weeks, with many residents returning to Fort McMurray, and while there is a great deal of work ahead, I am confident that together we will rebuild our communities and make them home again."

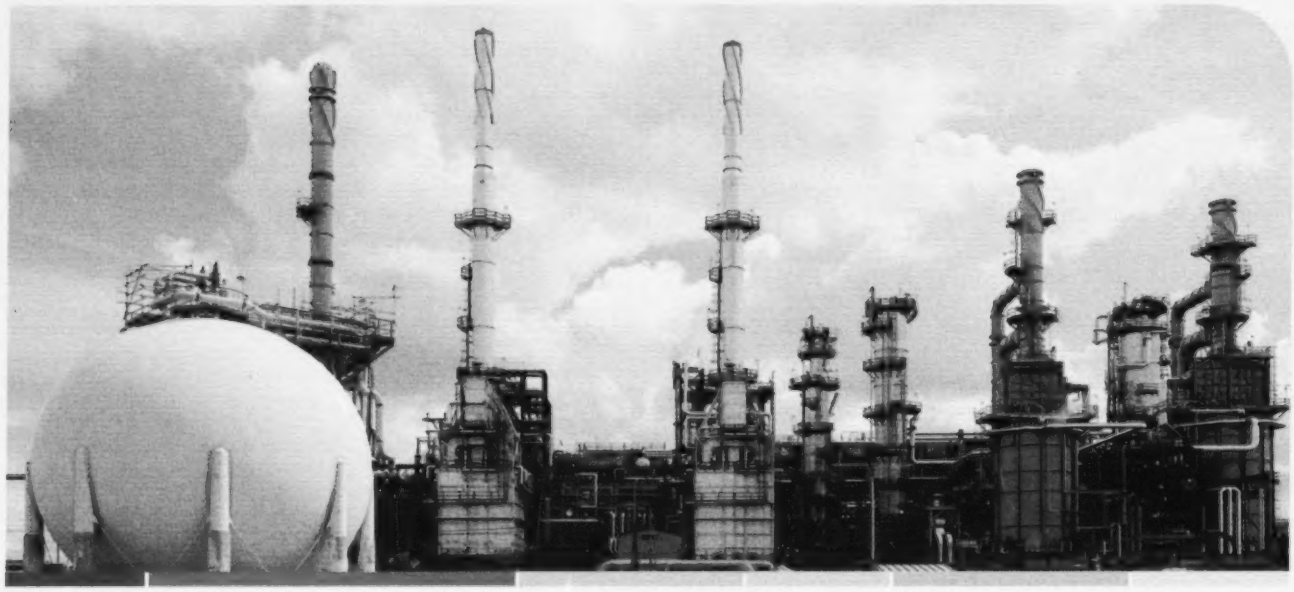
ENERGY MINISTER ADDRESSES TRANS MOUNTAIN PIPELINE ANNOUNCEMENT

Following the National Energy Board's recommended conditional approval of the Trans Mountain Pipeline expansion project in May, Energy Minister Margaret McCuaig-Boyd issued the following statement:

"Today's recommendation by the National Energy Board fits a responsible national approach to energy infrastructure. Canada is balancing the need for much stronger action on climate change with the need to pay for that action, by sustainably developing our natural resources—including our energy resources.

"Finding this balance will create jobs and economic prosperity, and help Canada overcome the current commodity price shock.

"We're getting there. Albertans are now world leaders on addressing climate change. Our province's Climate Leadership Plan demonstrates that a forward-looking energy jurisdiction can be a world leader in the fight against climate change.



We are reducing [greenhouse gas] emissions by putting a price on them. We are implementing a hard emissions cap in the oil sands. We are dramatically cutting methane emissions. We are phasing out coal. And we are investing billions of dollars into renewable energy and into energy efficiency."

ENVIRONMENT MINISTER INTRODUCES CLIMATE LEADERSHIP IMPLEMENTATION ACT

Environment and Parks Minister Shannon Phillips introduced the Climate Leadership Implementation Act, which puts into effect key elements of Alberta's Climate Leadership Plan. This proposed law will create jobs by investing in a higher-value, lower-carbon, energy-efficient economy; help Alberta reduce greenhouse gas emissions and energy consumption; and improve the energy efficiency of Alberta homes, businesses and public buildings. The plan is widely supported by industry, environmental groups and communities across the province.

If passed, the proposed legislation would:

- set in law Alberta's carbon levy and carbon levy rebate;
- ensure revenue from the carbon levy is invested into actions that address climate change; and
- establish Energy Efficiency Alberta.

"Our plan to reduce carbon pollution will diversify the economy, create jobs, protect the health of Albertans and erase any doubt about Alberta's environmental record," says Phillips. "It's the right thing to do today and for future generations."

PREMIERS PARTNER ON ENERGY AND CLIMATE CHANGE INITIATIVES

On May 26, Alberta Premier Rachel Notley and Ontario Premier Kathleen Wynne met in Edmonton to discuss opportunities to partner on energy and climate change initiatives.

The Premiers announced a new Memorandum of Understanding (MOU) between Alberta's Climate Change and Emissions Management Corporation (CCEMC) and Ontario Centres of Excellence (OCE).

The MOU commits CCEMC and OCE to examining opportunities including, but not limited to:

- reducing greenhouse gas emissions in the production, transportation and use of natural resources in Alberta and Ontario;
- accelerating the development of renewable energy and energy storage; and
- fostering new and innovative uses of CO_2.

This partnership will combine the strengths of CCEMC and OCE to help Alberta and Ontario reduce greenhouse gas emissions and shift to a lower-carbon economy by identifying technology development and demonstration projects. The cleantech initiatives that result from the MOU will benefit the environment, nurture and grow the sector, and enhance Ontario and Alberta's response to climate change. ■

LABOUR UPDATE

JOB LOSSES IN ALBERTA'S OIL AND GAS SECTOR EXPECTED TO RISE

More oil workers are going to lose their jobs in 2016 before an expected modest turnaround in commodity prices in 2017 brings some stability back to the labour force, according to a new report by PetroLMI.

Industry employment is expected to contract by up to 24,400 jobs in 2016 as prices remain low and spending cuts continue, according to the *Labour Market Outlook 2016 to 2020 for Canada's Oil and Gas Industry*, released in April by PetroLMI, a division of Enform.

Additionally, companies are not expected to fill positions left vacant by retirees in 2016. Instead, those vacated positions are more likely to be used as a way to reduce workforce numbers and further reduce costs during this period of continued low oil prices.

"The industry underwent significant job losses in 2015 due to the rapid decline in oil prices, and that trend is continuing in 2016," says Enform's Carol Howes, vice-president of communications and PetroLMI.

"Based on assumptions that oil prices will start to rise in 2017, some rehiring is expected to begin as capital investment resumes and there is a need to fill positions left vacant by retiring baby boomers."

The *Labour Market Outlook 2016 to 2020 for Canada's Oil and Gas Industry* provides an overview of workforce requirements by sector, including conventional exploration and production, oil and gas services, oil sands and pipelines, as well as by key oil and gas operating regions.

The report provides a range of labour market projections for the industry based on two scenarios, which include assumptions for oil prices, capital and operating expenditures, and industry activity. In a lower scenario, oil prices remain below US$60/bbl to 2020 and net hiring requirements for the industry reach 46,435 jobs, assuming historical retirements remain the same. In a higher scenario, oil prices increase to the US$60-$80/bbl range by 2020 and net hiring reaches 55,305 jobs.

Regionally, Alberta, the hub of Canada's oil and gas industry, has been the most impacted by the downturn, witnessing the largest drop in employment. Companies are expected to continue to find opportunities to reduce costs across their operations in Alberta and the rest of Canada in order to survive the downturn. Investing in innovation and technology to drive efficiencies and productivity will be key to increasing profitability in the future, says the report.

NEW CHAIR APPOINTED TO ALBERTA APPRENTICESHIP BOARD

j'Amey Holroyd has been appointed to a three-year term as the chair of the Alberta Apprenticeship and Industry Training Board, the first time in the board's 71-year history that it has been chaired by a woman.

The new chair has more than 17 years of experience in the industrial construction and maintenance industry. She holds a trade certificate with an Interprovincial Standards Red Seal endorsement in the boilermaker trade and is an active member of the Boilermakers Union, with a Blue Seal Certificate. Holroyd also holds a master's degree in leadership.

She is also a director and board member of Tradewinds to Success Training Society and chairs the Building Trades of Alberta Training Co-ordinators Group.

The Apprenticeship and Industry Training Board plays a vital leadership role in developing Alberta's trades professionals to meet the needs of Alberta's industry and society.

"I look forward to working with my fellow distinguished board members and strong industry partners to continue the excellent work Alberta's apprenticeship and industry training community has done," Holroyd said. "I'm honoured to be named as chair of the Apprenticeship and Industry Training Board and excited to assist in positioning Alberta for great future success."

The board advises the advanced education about the needs of the labour market for trades and skilled workers, while promoting careers in the designated trades and occupations to Albertans. The board is also responsible for setting standards and requirements for training and certification in trades and occupations programs. ■

WHAT'S NEW IN THE OIL SANDS

BUSINESS

The massive wildfire in the Wood Buffalo region that forced the evacuation of Fort McMurray on May 3 had considerable impact on nearby oilsands facilities. Projects north and south of the city helped in the evacuation and then were shut down and evacuated due to increasing smoke and fire risk.

At the peak of the fire risk, 12 projects were idled, totaling production loss of about 1.4 million bbls/d. North of Fort McMurray this included Suncor base, Syncrude, Shell Albian, Suncor Firebag, Imperial Oil Kearl, Suncor MacKay River and Husky Sunrise. South of the city this included Nexen Long Lake, ConocoPhillips Surmont, Statoil Leismer, JACOS Hangingstone and Athabasca Oil Hangingstone.

The full impact of the approximately two-week loss to the Canadian economy has yet to be determined, but estimates from the Conference Board of Canada predict a $1-billion hit to national GDP.

Cenovus Energy has launched its biggest habitat restoration plan ever. The 10-year, $32-million project is located near Cenovus's SAGD operations in northeastern Alberta. The company will treat forest fragmentation within an area of approximately 3,900 square kilometres and plant more than four million trees.

Under the Species at Risk Act, the federal government requires provinces with caribou populations to put in place action and range plans for caribou recovery by October 2017.

Pengrowth Energy Corporation has been granted regulatory approval to expand its Lindbergh SAGD project, adding 17,500 bbls/d of capacity and taking total nameplate production capacity to about 30,000 bbls/d. The project is located in the Cold Lake oilsands region.

Pengrowth began operations at its Lindbergh pilot in the second quarter of 2012. Start up of the first commercial phase was in the second quarter of 2015 and completion of a capacity-expanding optimization project happened later in the year.

The latest Alberta Energy Regulator data shows Lindbergh consistently performs well. Pengrowth successfully achieved nameplate capacity at Phase 1 within six months of start up, with a steam to oil ratio of 2.3:1. Design for the expansion project allows for a steam to oil ratio of 3.6:1.

To generate interest in company assets, Connacher Oil and Gas Limited has obtained approval to initiate a sale and investment solicitation process to be conducted in conjunction with the CCAA proceedings.

The assets include Connacher's two producing SAGD facilities south of Fort McMurray, as well as 100 per cent working interest in approximately 87,000 net acres of oilsands leases with estimated gross 2P reserves of 436 million barrels.

The Alberta and federal governments have established their joint review panel for the $20.6-billion Frontier oilsands mine proposed by Teck Resources Limited.

Last year, Teck announced it was delaying the proposed mine by five years and building the project in two phases instead of four, with a slightly smaller disturbance area and production rate.

The proposed project has production capacity of about 260,000 bbls/d and a 41-year lifespan. First oil is anticipated in the first quarter of 2026.

Canadian Natural started commissioning at the end of May on a 45,000-bbl/d expansion of upgraded crude oil production at the Horizon oilsands project, the company says.

Major components of the project will be tied in during a planned 35-day major turnaround scheduled for early July, after which point Canadian Natural says commissioning will continue in a staged approach to meet the start-up date of October 2016.

With the completion of Phase 2B, the company expects Horizon's 2016 exit nameplate capacity to be rated at 182,000 bbl/d of synthetic crude oil with a targeted utilization rate range of 92 per cent to 96 per cent.

WHAT'S NEW IN THE OIL SANDS

TECHNOLOGY

Imperial Oil's solvent-assisted (SA) SAGD pilot will soon be "experimental" no more. The company has applied to the Alberta Energy Regulator to terminate its approval for the SA-SAGD experimental scheme but still operate the wells as part of its 160,000-bbl/d Cold Lake operation.

The application says the purpose of the pilot was to evaluate the effectiveness of SA-SAGD in the field and that evaluation is now complete, with the results indicating an increase in bitumen rates and improvement in the steam to oil ratio compared to standard SAGD.

Imperial's proposed Aspen in situ project would be its first commercial-scale SA-SAGD project. Regulatory approval is still pending, but Imperial has said an investment decision could come as early as 2017.

Acceleware will be partnering with GE to develop potentially game changing critical power components and complete a pilot test of a radio-frequency technology to reduce oilsands costs and greenhouse gas emissions. The technology, called RF XL, is expected to be deployed on a typical oilsands well pair in 2017.

It's believed that RF XL can deliver operating cost savings of up to 50 per cent and has potential capital cost reductions of 66 per cent compared to the industry average. As the technology requires no external water, solvents or chemicals, it should reduce GHG emissions by 50 per cent.

Cenovus Energy is considering solar panels and wind turbines as it adjusts to changing patterns of energy demand.

The company is currently investigating renewable energy investments. "Over the next two to three years our prime focus is going to be around the emissions side of oil, both in terms of production and consumption," says chief executive officer Brian Ferguson. He added that solar will be an important part of the future energy mix.

Cenovus and its competitors are testing new technologies such as solvents and microwaves to melt bitumen. Along with Suncor, Cenovus has invested in a clean tech fund.

In the coming years, the company expects to lower emissions per barrel by 50 per cent.

ClearSign Combustion Corporation has signed a deal with a large oilsands producer to design and engineer its technology for potential retrofit at 40 Alberta once-through steam generators (OTSGs). ClearSign says the technology, called Duplex, can cost-efficiently lower greenhouse gas emissions.

Fuel and air are mixed pre-combustion and then combusted in a Duplex tile, which has a series of small channels in it that allows for precise combustion.

According to chief executive officer Stephen Pirnat, Duplex technology allows people in the enhanced oil recovery market to get sub-five ppm NOX low CO and retrofit existing low-NOX burner technology at a fraction of the cost of, for example, selected catalytic reduction systems.

Pirnat could not disclose the name of the producer, but he indicated that there are fewer than five companies operating OTSGs in western Canada with a fleet this significant. He expects that after the technology is validated, the two companies will jointly release a statement.

Fluor Corporation has been recognized for its modularization innovation developed for Shell's Quest carbon capture and storage (CCS) project.

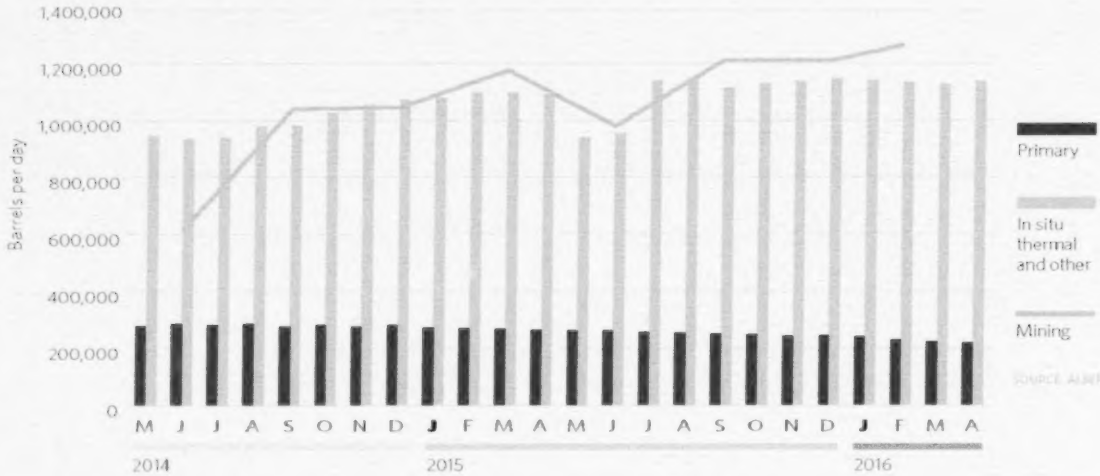
The Construction Owners Association of Alberta named Fluor the 2016 Best Practices award winner. These awards annually recognize companies and organizations that have provided outstanding leadership in developing, implementing and improving industry best practices.

Fluor implemented 3rd Gen Modular Execution for construction of the Quest CCS project. 3rd Gen is designed to increase the portion of a facility that can be modularized by consolidating equipment and components into the modules, allowing for decentralized electrical and instrumentation distribution and significantly reducing plot plan footprints.

The process has resulted in improved construction and safety performance and reduced onsite labour, material quantities and capital costs, COAA said. 3rd Gen helped reduce the plot plan by 20 per cent and capital costs by 30 per cent from initial estimates on the Quest project.

OIL SANDS PRODUCTION DATA

Alberta oil sands production by extraction method



SOURCE: ALBERTA ENERGY REGULATOR

Alberta crude bitumen and synthetic crude production

SOURCE: ALBERTA ENERGY REGULATOR

OIL SANDS TECHNOLOGY LEGEND *See oil sands project status listing on page 10*

ADC (Upgrading) Accelerated decontamination

AIRINJ Air injection

C & SC Cyclic and solvent cyclic

CCC (Upgrading) Cold catalytic cracking

C-SAGD Cyclic steam assisted gravity drainage

CSS Cyclic steam stimulation

ESEIEH Enhanced solvent extraction incorporating electromagnetic heating

ET-DSP Electro-thermal dynamic stripping

HCSS Horizontal cyclic steam stimulation

HTL Heavy-to-light upgrading process

In situ Production technology undisclosed; will use drilling and enhanced recovery

LP-SAGD Low-pressure steam assisted gravity drainage

Mining Truck and shovel mining

Nsolv purified condensing solvent extraction technology

Steam & CO_2 Steam & CO_2 Co-gen Co-injection

Orcrude Primary upgrading process

SAGD Steam assisted gravity drainage

SAP Solvent aided process

SC-SAGD Solvent cyclic steam assisted gravity drainage

TAGD Thermal assisted gravity drainage

THAI Toe to heel air injection

UPG Bitumen upgrading

USP (Upgrading) Ultra-selective pyrolysis

VSD Vertical steam drive

PROJECT LISTINGS

See oil sands project technology viewfoil on page 9

Updated status of oil sands projects in Alberta | As of June 2016

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABASCA REGION — MINING				
Canadian Natural Resources Limited				
Horizon				Updated: Mar 2016
The start-up of Horizon Phase 2B is targeted for October 2016 and will add 45,000 bbls/d of production capacity. Phase 3 is currently on schedule & budget with start-up in Q4 2017.				
Phase 1	135,000	2008	Operating	**Mining**
Reliability - Tranche 2	5,000	2014	Operating	**Mining**
Phase 2A	12,000	2014	Operating	**Mining**
Phase 2B	45,000	2016	Construction	**Mining**
Phase 3	80,000	2017	Construction	**Mining**
Imperial Oil Limited				
Kearl				Updated: May 2016
Imperial says that Kearl bitumen production averaged 165,000 bbls/d in Q1. The increase was largely due to continued strong performance from the expansion project and optimization efforts at the combined Kearl operation.				
Phase 1	110,000	2013	Operating	**Mining**
Phase 2	110,000	2015	Operating	**Mining**
Phase 3	80,000	TBD	On Hold	**Mining**
Phase 4 Debottlenecking	45,000	TBD	On Hold	**Mining**
Shell Albian Sands				
Jackpine				Updated: Sep 2015
Phase 1A	100,000	2010	Operating	**Mining**
Phase 1B	100,000	TBD	Approved	**Mining**
Expansion	100,000	TBD	Approved	**Mining**
Muskeg River				Updated: Nov 2015
Project partner Marathon Oil says that record production of approximately 285,000 bbls/d during Q3 was largely due to improved operational reliability and no planned maintenance.				
Commercial	155,000	2002	Operating	**Mining**
Expansion & Debottlenecking	115,000	TBD	Approved	**Mining**
Pierre River				Updated: Mar 2015
Shell has withdrawn its application for the Pierre River project, saying it wants to focus on its existing oilsands operations. The company says it will continue to hold the Pierre River leases and may re-apply in the future.				
Phase 1	100,000	TBD	Cancelled	**Mining**
Phase 2	100,000	TBD	Cancelled	**Mining**
Suncor Energy Inc.				
Base Operations				Updated: Feb 2016
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
Millennium Mine	294,000	1967	Operating	**Mining**
Steepbank Debottlenecking Phase 3	4,000	2007	Operating	**Mining**
Millennium Debottlenecking	23,000	2008	Operating	**Mining**
North Steepbank Extension	180,000	2012	Operating	**Mining**
Fort Hills				Updated: Feb 2016
Teck Resources reports that construction is more than 55 per cent complete at the end of Q1 2016.				
Phase 1	160,000	2017	Construction	**Mining**
Debottleneck	20,000	TBD	Approved	**Mining**
Voyageur South				Updated: May 2012
Suncor considers Voyageur South to be a "longer-term" project and has not confirmed a start-up date.				
Phase 1	250,000	2024	Announced	**Mining**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Syncrude Canada Ltd.				
Mildred Lake/Aurora				Updated: Apr 2016
In December, Syncrude performed coker maintenance originally scheduled for mid 2016. Suncor is the process of purchasing Murphy Oil Corporations 5 per cent stake in Syncrude, upon closing Suncor will own 53.74 per cent of Syncrude. On Feb. 12, 2016, the company submitted supplemental information to the AER for the mine extension project, which is under review.				
Base Mine Stage 1 & 2 Expansion	290,700	1978	Operating	**Mining**
Stage 3 Expansion	116,300	2006	Operating	**Mining**
Centrifuge Tailings Management	TBD	TBD	Operating	**Mining**
Aurora SouthTrain 1	100,000	TBD	Approved	**Mining**
Aurora SouthTrain 2	100,000	TBD	Approved	**Mining**
Mildred Lake Mine Extension (MLX)	184,000	2023	Application	**Mining**
Teck Resources Limited				
Frontier				Updated: Jun 2016
Teck has filed a project update for the Frontier mining development. The capital cost has been increased to $20.6 billion and the total capacity is now 260,000 bbls/d. The regulatory review process is expected to continue through 2016, making 2017 the earliest a decision report is expected. Alberta's environmental impact assessment director says that Teck's environmental impact assessment report for the Frontier project has been deemed complete.				
Phase 1a	85,000	2026	Application	**Mining**
Phase 1b	85,000	2027	Application	**Mining**
Phase 2	90,000	2037	Application	**Mining**
Total E&P Canada Ltd.				
Joslyn North Mine				Updated: Mar 2015
Total has withdrawn the regulatory applications for the Joslyn North Mine.				
Phase 1	100,000	TBD	On Hold	**Mining**
NORTH ATHABASCA REGION — IN SITU				
Athabasca Oil Corporation				
Birch				Updated: Feb 2015
Athabasca lists Birch as one of its long term assets.				
Phase 1	12,000	TBD	Announced	**SAGD**
Dover West Carbonates (Leduc)				Updated: Mar 2015
Athabasca lists Dover West as one of its long-term assets.				
Phase 1 Demonstration	6,000	TBD	Approved	**SAGD**
Phase 2 Demonstration	6,000	TBD	Application	**SAGD**
Dover West Sands & Clastics				Updated: Apr 2016
Athabasca has been assessing the development timeline of the Dover West Sands Project. Given the change in global commodity prices has affected the ability to finance projects in the near term and the considerable uncertainty in regulatory and royalty regimes and the present shift in focus to Athabasca's Hangingstone asset area in the immediate future, a decision regarding proceeding with the regulatory application has not yet been taken, but it is likely that management will advance the regulatory application during 2016.				
Phase 1	12,000	TBD	Application	**SAGD**
Phase 2	35,000	2019	Announced	**SAGD**
Phase 3	35,000	2020	Announced	**SAGD**
Phase 4	35,000	2022	Announced	**SAGD**
Phase 5	35,000	2024	Announced	**SAGD**
BP p.l.c.				
Terre de Grace				Updated: Nov 2015
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2020.				
Pilot	10,000	TBD	Approved	**SAGD**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Brion Energy Corporation				
Dover				Updated: Apr 2016
Brion Energy says that the Dover project is on hold.				
Dover Experimental Pilot	2,000	2017	Approved	SAGD
Dover North Phase 1	50,000	TBD	On Hold	SAGD
Dover North Phase 2	50,000	TBD	Approved	SAGD
Dover South Phase 3	50,000	2021	Approved	SAGD
Dover South Phase 4	50,000	2023	Approved	SAGD
Dover South Phase 5	50,000	2025	Approved	SAGD
Mackay River				Updated: Apr 2016
Brion revealed at the 2016 CAPP investment symposium in Toronto that construction is mechanically complete. Steaming will start this summer with first oil expected late 2016 or early 2017.				
Phase 1	35,000	2017	Construction	SAGD
Phase 2	40,000	TBD	Approved	SAGD
Phase 3	40,000	2020	Approved	SAGD
Phase 4	35,000	2022	Approved	SAGD
Canadian Natural Resources Limited				
Birch Mountain				Updated: Dec 2013
Phase 1	60,000	TBD	Announced	SAGD
Phase 2	60,000	TBD	Announced	SAGD
Cenovus Energy Inc.				
East McMurray				Updated: Dec 2013
Phase 1	30,000	TBD	Announced	SAGD
Steepbank				Updated: Dec 2013
Phase 1	30,000	TBD	Announced	SAGD
Telephone Lake				Updated: Sep 2015
Cenovus says it continues to review development options for Telephone Lake after receiving regulatory approval in late 2014.				
Phase A	45,000	TBD	On Hold	SAGD
Phase B	45,000	TBD	Approved	SAGD
E-T Energy Ltd.				
Poplar Creek				Updated: Feb 2016
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	1,000	2012	Suspended	ET-DSP
Grizzly Oil Sands Ulc				
Thickwood				Updated: Mar 2016
This project application has been withdrawn and closed by the AER.				
Phase 1	6,000	TBD	Cancelled	CSS & SAGD
Phase 2	6,000	TBD	Cancelled	CSS & SAGD
Husky Energy Inc.				
Saleski				Updated: Mar 2016
The AER is waiting for an Order in Council from the Government of Alberta. Under the Oil Sands Conservation Act (OSCA), an Order in Council is required for new in-situ oil sands projects that have more than 2,000 bbls/d of production. The AER has completed its technical review of the application.				
Carbonate Pilot	3,000	TBD	Application	CSS
Sunrise				Updated: Jun 2016
Husky says that the Sunrise project will not reach full capacity until 2017, due to the shut-down of operations during the Fort McMurray wildfires.				
Phase 1A	30,000	2015	Operating	SAGD
Phase 1B	30,000	2015	Operating	SAGD
Phase 2A	35,000	TBD	On Hold	SAGD
Phase 2B	35,000	TBD	Approved	SAGD
Future Phases	70,000	TBD	Approved	SAGD
Imperial Oil Limited				
Aspen				Updated: Jun 2016
Alberta's environmental impact director says Imperial's environmental impact assessment report for the Aspen project has been deemed complete. Imperial has said that a final investment decision could me made as early as 2017.				
Phase 1	75,000	2020	Application	SA-SAGD
Phase 2	75,000	TBD	Application	SA-SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Ivanhoe Energy Inc.				
Tamarack				Updated: Apr 2016
Project is cancelled. Suncor has purchased the leases associated with Ivanhoe. FluidOil Ltd., a London-based company, has purchased the HTL technology and the San Antonio, Texas testing facility.				
Phase 1	20,000	TBD	Cancelled	SAGD
Phase 2	20,000	TBD	Cancelled	SAGD
Koch Exploration Canada Corporation				
Dunkirk				Updated: Mar 2016
Koch has withdrawn the Dunkirk project from the regulatory review process.				
Commercial Demonstration	2,000	2017	Cancelled	SAGD
Phase 1	30,000	2018	Cancelled	SAGD
Phase 2	30,000	TBD	Cancelled	SAGD
Marathon Oil Corporation				
Birchwood				Updated: Mar 2016
This application has been closed by the AER.				
Demonstration	12,000	TBD	Cancelled	SAGD
Oak Point Energy Ltd.				
Lewis				Updated: Sep 2015
Oak Point Energy says the Lewis project is well positioned (no additional work required) for exploitation when oil prices recover.				
Pilot	1,720	TBD	Approved	SAGD
Prosper Petroleum Ltd.				
Rigel				Updated: Apr 2016
An objection was filed with this project in April 2015, confidential documents have been filed in April 2016.				
Phase 1	10,000	2017	Application	SAGD
Southern Pacific Resource Corp.				
STP McKay				Updated: May 2015
Southern Pacific and certain of its subsidiaries have obtained creditor protection under the Companies' Creditors Arrangement Act. The STP McKay is being suspended to preserve capital until oil prices recover.				
Phase 1	12,000	2012	Suspended	SAGD
Suncor Energy Inc.				
Dover				Updated: Nov 2015
N-Solv Corporation says that since start-up in Q2 2015, the pilot plant has produced over 60,000 barrels of oil.				
Nsolv BEST Pilot	300	2014	Operating	SAGD
ESEIEH Pilot	TBD	TBD	Operating	SAGD
Firebag				Updated: Feb 2016
Suncor says that work at Firebag continues to focus on well pad construction to sustain existing production, and has deferred planned maintenance from 2016 to 2017. Effective Jan. 1, 2016, Suncor says nameplate capacity at Firebag increased from 180,000 to 203,000 bbls/d as a result of completion of debottlenecking activities.				
Stage 1	35,000	2004	Operating	SAGD
Stage 2	35,000	2006	Operating	SAGD
Cogeneration and Expansion	25,000	2007	Operating	SAGD
Stage 3	42,500	2011	Operating	SAGD
Stage 4	42,500	2012	Operating	SAGD
Stage 5	62,500	TBD	Approved	SAGD
Stage 6	62,500	TBD	Approved	SAGD
Stage 3-6 Debottlenecking	23,000	2015	Operating	SAGD
Lewis				Updated: Aug 2013
Phase 1	40,000	TBD	Announced	In Situ
Phase 2	40,000	TBD	Announced	In Situ
MacKay River				Updated: Nov 2015
Suncor says that spending is currently focused on ongoing well pad construction to maintain existing production levels.				
Phase 1	33,000	2002	Operating	SAGD
Debottlenecking	5,000	2014	Operating	SAGD
MR2	20,000	TBD	On Hold	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Sunshine Oilsands Ltd.				
Legend Lake				Updated: Mar 2016
Regulatory approval is expected in 2016. Once the Legend Lake project is sanctioned for development and construction, additional financing will need to be secured to proceed.				
Phase A1	10,000	TBD	Application	SAGD
Phase A2	30,000	TBD	Announced	SAGD
Phase B1	30,000	TBD	Announced	SAGD
Phase B2	30,000	TBD	Announced	SAGD
Thickwood				Updated: Mar 2016
Once the Thickwood project is sanctioned for development and construction, additional financing will need to be secured to proceed.				
Phase A1	10,000	TBD	Approved	SAGD
Phase A2	30,000	TBD	Announced	SAGD
Phase B	30,000	2021	Announced	SAGD
West Ells				Updated: Mar 2016
Construction of the West Ells facilities is complete with first oil having been achieved in December 2015. All West Ells Phase I well pairs are either on steam injection or on production. The company is fully committed to advancing its corporate initiatives and expects to operate the plant at a loss during the current challenging oil price environment to prove the reservoir performance.				
Phase A1	5,000	2015	Operating	SAGD
Phase A2	5,000	TBD	Approved	SAGD
Phase A3	30,000	TBD	Announced	SAGD
Phase B	20,000	TBD	Announced	SAGD
Phase C1	30,000	TBD	Announced	SAGD
Phase C2	30,000	TBD	Announced	SAGD
Value Creation Inc.				
Audet				Updated: Sep 2015
Value Creation has acquired SilverWillow Energy and its Audet project.				
Pilot	12,000	TBD	Application	SAGD
SOUTH ATHABASCA REGION — IN SITU				
Athabasca Oil Corporation				
Hangingstone				Updated: May 2016
Hangingstone project 1 in now 10 months into its production ramp up with 23 well pairs converted to SAGD production. Volumes for the quarter were partially impacted by operations maintenance. The Environmental Impact Assessment director has deemed the EIA report complete for the Hangingstone expansion project. Athabasca Oil is required to resolve SOCs on the application. Prior to the Fort McMurray Fires production has reached 9,000 bbls/d.				
HS-1	12,000	2015	Operating	SAGD
HS-2A Debottlenecking (1 and 2)	8,000	TBD	Application	SAGD
HS-2B Expansion	32,000	2019	Application	SAGD
HS-3	30,000	2021	Application	SAGD
BlackPearl Resources Inc.				
Blackrod				Updated: Apr 2016
Approval of the 80,000-bbl/d commercial application, which is under review by the AER, is expected in 2016. BlackPearl may seek a joint venture arrangement to accelerate development, or may develop the project in smaller stages similar to its Onion Lake heavy oil project.				
Pilot	800	2011	Operating	SAGD
Phase 1	20,000	TBD	Application	SAGD
Phase 2	30,000	TBD	Application	SAGD
Phase 3	30,000	TBD	Application	SAGD
Canadian Natural Resources Limited				
Gregoire Lake				Updated: Dec 2013
Phase 1	60,000	TBD	Announced	SAGD
Phase 2	60,000	TBD	Announced	SAGD
Grouse				Updated: Mar 2016
The AER is waiting for CNRL to resolve outstanding statements of concern filed on the application. The AER has completed its technical review of the application.				
Commercial	40,000	2020	Application	SAGD
Kirby				Updated: Mar 2016
Canadian Natural says that production at Kirby South continues to ramp up to design capacity. Q4 2015 volumes averaged 33,000 bbls/d, and in November production exceeded 41,000 bbls/d.				
KS1 - Kirby South	40,000	2013	Operating	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Kirby (continued)				Updated: Mar 2016
KN1 - Kirby North	40,000	TBD	On Hold	SAGD
KN2 - Kirby North	60,000	TBD	Approved	SAGD
Cavalier Energy Inc.				
Hoole				Updated: May 2015
Regulatory approval for the first phase of the Hoole project was granted in June 2014. Development of this phase is dependent upon Cavalier Energy securing financing and sanctioning by its board of directors.				
Phase 1	10,000	TBD	Approved	SAGD
Phase 2A	35,000	TBD	Announced	SAGD
Phase 2B	35,000	TBD	Announced	SAGD
Cenovus Energy Inc.				
Christina Lake				Updated: May 2016
Cenovus is looking into building a diluent recovery unit at its Bruderheim crude-by-rail terminal. The Phase F expansion is nearing completion, with first oil expected in the third quarter of 2016. Phase H received regulatory approval in December 2015.				
Phase 1A	10,000	2002	Operating	SAGD
Phase 1B	8,800	2008	Operating	SAGD
Phase C	40,000	2011	Operating	SAGD
Phase D	40,000	2012	Operating	SAGD
Phase E	40,000	2013	Operating	SAGD
Optimization (Phases C,D,E)	22,000	2015	Operating	SAGD
Phase F	50,000	2016	Construction	SAGD
Phase G	50,000	TBD	On Hold	SAGD
Phase H	50,000	TBD	Approved	SAGD
Foster Creek				Updated: Feb 2016
Cenovus says that the Phase G expansion remains on track for expected production late in the third quarter 2016. A scheduled turnaround has been deferred into 2017.				
Phase A	24,000	2001	Operating	SAGD
Phase B Debottlenecking	6,000	2003	Operating	SAGD
Phase C Stage 1	10,000	2005	Operating	SAGD
Phase C Stage 2	20,000	2007	Operating	SAGD
Phase D	30,000	2009	Operating	SAGD
Phase E	30,000	2009	Operating	SAGD
Phase F	30,000	2014	Operating	SAGD
Phase G	30,000	2016	Construction	SAGD
Phase H	30,000	2017	On Hold	SAGD
Future Optimization (Phases F,G,H)	35,000	TBD	Announced	SAGD
Phase J	50,000	TBD	Approved	SAGD
Future Optimization	15,000	TBD	Announced	SAGD
Grand Rapids				Updated: Feb 2016
Cenovus has suspended operations at the Grand Rapids pilot due to low market conditions.				
Pelican Lake Pilot	600	2011	Suspended	SAGD
Pelican Upper Grand Rapids Phase A	10,000	TBD	On Hold	SAP-SAGD
Pelican Upper Grand Rapids Phase B	32,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase C	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase D	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase E	32,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase F	29,000	TBD	Approved	SAP-SAGD
Pelican Upper Grand Rapids Phase G	19,000	TBD	Approved	SAP-SAGD
Narrows Lake				Updated: May 2016
Plans for 2016 include detailed engineering for Phase A.				
Phase A	45,000	TBD	On Hold	SAP-SAGD
Phase B	45,000	TBD	Approved	SAP-SAGD
Phase C	40,000	TBD	Approved	SAP-SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
West Kirby				Updated: Dec 2013
Phase 1	30,000	TBD	Announced	SAGD
Winefred Lake				Updated: Dec 2013
Phase 1	30,000	TBD	Announced	SAGD
CNOOC Limited				
Long Lake				Updated: Jun 2016
Phase 1	72,000	2008	Operating	SAGD
Kinosis (K1A)	20,000	2014	Operating	SAGD
Kinosis (K1B)	37,500	TBD	Approved	SAGD
Connacher Oil and Gas Limited				
Great Divide				Updated: May 2016
Connacher is reducing production at the Great Divide project to between 7,000 bbls/d and 8,000 bbls/d in light of "exceptionally low commodity prices." Connacher has filed for CCAA protection and has received permission to sell leases and plants.				
Pod One	10,000	2007	Operating	SAGD
Algar	10,000	2010	Operating	SAGD
Expansion 1A	12,000	TBD	Approved	SAGD
Expansion 1B	12,000	TBD	Approved	SAGD
ConocoPhillips Canada Limited				
Surmont				Updated: Apr 2016
ConocoPhillips says that production at Surmont 2 is expected to ramp up through 2017. The Surmont 3 project application/EIA were submitted in 2015. ConocoPhillips submitted responses to the second round of SIR on March 16, 2016.				
Pilot	1,200	1997	Operating	SAGD
Phase 1	30,000	2007	Operating	SAGD
Phase 2	118,000	2015	Operating	SAGD
Phase 2 Debottlenecking	57,000	TBD	Approved	SAGD
Phase 3 - Tranche 1	45,000	2020	Application	SAGD
Phase 3 - Tranche 2	45,000	2021	Application	SAGD
Phase 3 - Tranche 3	45,000	2023	Application	SAGD
Devon Canada Corporation				
Jackfish				Updated: Feb 2016
Gross production at Jackfish 3 exceeded nameplate capacity, averaging 38,100 bbls/d in the fourth quarter.				
Phase 1	35,000	2007	Operating	SAGD
Phase 2	35,000	2011	Operating	SAGD
Phase 3	35,000	2014	Operating	SAGD
Jackfish East				Updated: Sep 2012
Expansion	20,000	2018	Announced	SAGD
Pike				Updated: Jun 2015
Devon has applied to amend total capacity of the Pike project to 70,000 bbls/d from 105,000 bbls/d, using 52 well pads and 12 once-through steam generators. FEED is expected to be completed in 2015 as well as a cost structure.				
1A	35,000	2019	Approved	SAGD
1B	35,000	2020	Approved	SAGD
1C	35,000	TBD	Cancelled	SAGD
Grizzly Oil Sands Ulc				
Algar Lake				Updated: Jul 2015
Grizzly has suspended operations at Algar due to low commodity prices.				
Phase 1	6,000	2014	Suspended	SAGD
Phase 2	6,000	TBD	Approved	SAGD
May River				Updated: Apr 2016
Regulatory approved is expected in 2016.				
Phase 1	6,000	TBD	Application	SAGD
Phase 2	6,000	TBD	Application	SAGD
Harvest Operations Corp.				
BlackGold				Updated: May 2016
Harvest says the CPF is complete and minor pre-commissioning activities were completed during 2015. Decision to complete commissioning and commence steam injection depends on a number of factors including the bitumen price environment. According to Harvest, it will cost $57 million-$67 million to start production under the current price environment.				
Phase 1	10,000	TBD	On Hold	SAGD
Phase 2	20,000	TBD	Approved	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Japan Canada Oil Sands Limited				
Hangingstone				Updated: May 2016
Production of the expansion project is expected in 2017. JACOS is moving employees to the expansion site from the pilot project, which has been shut-in due to a low oil price environment.				
Expansion	20,000	2016	Construction	SAGD
Hangingstone Pilot				Updated: May 2016
Japan Petroleum Exploration will not restart production at its Hangingstone oilsands pilot project due to low oil prices. The plant was shut down in early May in response to the Fort McMurray wild fires. The pilot project has applied to the AER to inject methane to retain reservoir pressures until Q1 2017 when start up activities could begin. The company will move staff to the expansion project, where production is expected to start in 2017.				
Pilot	11,000	1999	Suspended	SAGD
Koch Exploration Canada Corporation				
Muskwa				Updated: Jun 2014
Regulatory approval granted in June 2014.				
Pilot	10,000	TBD	Approved	SAGD
Laricina Energy Ltd.				
Germain				Updated: Jun 2016
During the first quarter of 2015, Laricina suspended operations at the Germain CDP.				
Phase 1 CDP	5,000	2013	Suspended	SC-SAGD
Phase 2	30,000	TBD	On Hold	SC-SAGD
Phase 3	60,000	TBD	On Hold	SC-SAGD
Phase 4	60,000	TBD	On Hold	SC-SAGD
Saleski				Updated: Jun 2016
Laricina reached approximately 80 per cent completion of detailed engineering and design for Saleski Phase 1 before the decision to defer further development of the project was made in the first quarter of 2015.				
Experimental Pilot	1,800	2011	Suspended	C & SC-SAGD
Phase 1	10,700	TBD	On Hold	C-SAGD
Phase 2	30,000	TBD	On Hold	In situ
Phase 3	60,000	TBD	Announced	In situ
Phase 4	60,000	2023	Announced	In situ
Phase 5	60,000	2026	Announced	In situ
Phase 6	60,000	TBD	Announced	In situ
MEG Energy Corp.				
Christina Lake				Updated: Mar 2016
MEG temporarily suspended operations between March 3-4 due to a small fire in the plant's sulphur treatment facility. The company says the fire did not impact the integrity of the main processing facilities, and resulted in no injuries. MEG has reduced its 2016 budget by 50 per cent to $1.70 million.				
Phase 1 Pilot	3,000	2008	Operating	SAGD
Phase 2A	22,000	2009	Operating	SAGD
Phase 2B	35,000	2013	Operating	SAGD
Phase 3A	50,000	TBD	Approved	SAGD
Phase 3B	50,000	TBD	Approved	SAGD
Phase 3C	50,000	TBD	Approved	SAGD
May River				Updated: Apr 2016
MEG has filed the proposed terms of reference to the Alberta Environmental Assessment Agency in April 2016.				
Phase 1	41,000	TBD	Announced	SAGD
Phase 2	41,000	TBD	Announced	SAGD
Phase 3	82,000	TBD	Announced	SAGD
Surmont				Updated: May 2015
The Environmental Assessment Director has deemed the Environmental Impact Assessment report complete for MEG Energy's Surmont Project.				
Phase 1	40,000	TBD	Application	SAGD
Phase 2	40,000	TBD	Application	SAGD
Phase 3	40,000	TBD	Application	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
OSUM Oil Sands Corp.				
Sepiko Kesik				Updated: Mar 2016
The AER is waiting for confirmation from the Aboriginal Consultation Office regarding First Nations consultation adequacy. The AER has completed its technical review of the application.				
Phase 1	30,000	2018	Application	CSS-SAGD
Phase 2	30,000	2020	Application	CSS-SAGD
PTT Exploration and Production				
Mariana - Thornbury				Updated: Apr 2016
PTTEP has postponed key development projects such as Mariana Oil Sands Project. PTTEP Responded to the second round of SIR requests on April 19, 2016.				
Phase 1	20,000	2021	Application	SAGD
Renergy Petroleum (Canada) Co., Ltd.				
Muskwa				Updated: Mar 2015
Renergy Petroleum received regulatory approval in January.				
Muskwa Experimental Pilot	440	2015	Approved	Steam & CO_2
Statoil				
Leismer				Updated: Jun 2015
Demonstration	10,000	2010	Operating	SAGD
Commercial	10,000	2011	Operating	SAGD
Expansion	20,000	TBD	Approved	SAGD
Northwest	20,000	TBD	Disclosed	SAGD
Suncor Energy Inc.				
Chard				Updated: Nov 2012
Phase 1	40,000	TBD	Announced	SAGD
Meadow Creek East				Updated: Dec 2015
Jacobs Engineering has been awarded the design basis memorandum contract for the Meadow Creek project, using a replication strategy.				
Phase 1	40,000	2020	Approved	SAGD
Phase 2	40,000	2022	Approved	SAGD
Surmont Energy Ltd.				
Wildwood				Updated: Apr 2016
In November, Surmont says they are going to finialize funding of US$370 million combined equity and debt during the first half of 2016.				
Phase 1	12,000	TBD	Application	SAGD
Value Creation Inc.				
Advanced TriStar				Updated: Apr 2016
Alberta Environmental Assessment Agency has deemed the Environmental Impact Assessment report compete for the ATS project. The review took 165 weeks.				
ATS-1	30,000	TBD	Application	SAGD
ATS-2	30,000	TBD	Application	SAGD
DOEx (Demonstration of Excellence)				Updated: May 2014
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	6,000	2018	Application	SAGD
COLD LAKE REGION — IN SITU				
Baytex Energy Corp.				
Gemini				Updated: Jun 2015
Baytex has made the decision to decommission the Gemini SAGD pilot due to low oil pricing. The company says that since operations started last year the pilot has successfully captured the key data associated with its objectives. The company's primary objective was to confirm reservoir production capacity to support a commercial scale project. Following regulatory approval for the commercial project, any subsequent sanctioning decision will be considered in the context of the project economics in a higher commodity price environment.				
Pilot	1,200	2014	Suspended	SAGD
Commercial	5,000	TBD	Approved	SAGD
Birchwood Resources Inc.				
Sage				Updated: Mar 2016
This application has been closed, application withdrawn.				
Pilot	5,000	TBD	Cancelled	LP-SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Canadian Natural Resources Limited				
Primrose & Wolf Lake				Updated: Nov 2015
Canadian Natural says that it continues to progress low pressure steamflood operations at Primrose Ease Area 1 as well as low pressure CSS operations at Primrose East Area 2, and that operations at Primrose East are meeting expectations.				
Wolf Lake	13,000	1985	Operating	CSS
Primrose South	45,000	1985	Operating	CSS
Primrose North	30,000	2006	Operating	CSS
Primrose East	32,000	2008	Operating	CSS
Devon Canada Corporation				
Walleye				Updated: Mar 2015
Devon says the Walleye project is currently on hold.				
Phase 1	9,000	TBD	Approved	SAGD
Husky Energy Inc.				
Caribou				Updated: Nov 2010
Demonstration	10,000	TBD	Approved	SAGD
Tucker				Updated: Jan 2016
Husky says that work is continuing to increase production and improve returns, with a new well pad that will add 5,000 bbls/d to bring production up to 20,000 bbls/d in 2017. Overall production at Tucker has averaged about 15,000 bbls/d since the beginning of September 2015.				
Phase 1	30,000	2006	Operating	SAGD
Imperial Oil Limited				
Cold Lake				Updated: Jun 2016
Looking ahead, Cold Lake, including Nabiye, will manage steaming strategies across all assets to enhance resource recovery. Late in 2015, Alberta Environment and Parks issued the final terms of reference for the Cold Lake Expansion project, the regulatory application was filed March 11. In June, Imperial filed an application to terminate the SA-SAGD pilot project and integrate the pilot into the Cold Lake project based on successful results.				
Phase 1-10	110,000	1985	Operating	CSS
Phase 11-13	30,000	2002	Operating	CSS
Experimental SA-SAGD	TBD	2010	Operating	SA-SAGD
Phase 14-16	40,000	2015	Operating	CSS
Expansion	55,000	TBD	Application	SA-SAGD
OSUM Oil Sands Corp.				
Orion				Updated: Jul 2015
Osum plans to revise the approved well pad development sequence at Orion, deferring two originally planned pads and developing on new sustaining pad as well as three new pads to increase production to the approved 20,000 bbls/d.				
Phase 1	10,000	2007	Operating	SAGD
Phase 2	10,000	TBD	Approved	SAGD
Taiga				Updated: Mar 2015
OSUM says that Taiga Phase 1 will be advanced in 2015-16 subject to financing.				
Phase 1	12,500	TBD	Approved	CSS-SAGD
Phase 2	12,500	TBD	Approved	CSS-SAGD
Phase 3	20,000	TBD	Approved	CSS-SAGD
Pengrowth Energy Corporation				
Lindbergh				Updated: May 2016
The AER has approved the Lindbergh expansion project, with a thermal well compatibility condition prior to drilling start. The 2016 allocation of $14 million of capital to Lindbergh will be directed to maintenance activities as well as further pre engineering and design for the phase two expansion. Final investment decision will be based in part on commodity prices.				
Pilot	1,260	2012	Operating	SAGD
Phase 1	11,240	2015	Operating	SAGD
Phase 1 Optimization	3,500	TBD	Operating	SAGD
Phase 2 Expansion	17,500	TBD	On Hold	SAGD
PEACE RIVER REGION — IN SITU				
Andora Energy Corporation				
Sawn Lake				Updated: May 2016
Project partner Pan Orient Energy says that the demonstration project will be suspended at the end of February 2016 due to the expectation that extremely low bitumen prices may continue for some time, as well as the estimated time required for regulatory approval of the 3,200 bbl/d expansion application, which Pan Orient says will be submitted in April 2016. It is expected that a reactivation of the demonstration project would be considered as part of the expansion.				
Demonstration	1,400	2014	Suspended	SAGD
Expansion	3,200	2019	Application	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Baytex Energy Corp.				
Cliffdale				Updated: Nov 2015
Baytex says that operations at the Cliffdale CSS pilot were suspended in late September 2015.				
Pilot	2,000	2011	Suspended	**CSS**
Dawson				Updated: Jul 2015
Touchstone Exploration has disposed of its interest in the Dawson area of Alberta for cash consideration of $2.15 million.				
Experimental Demonstration	TBD	2014	Suspended	**CSS**
Harmon Valley				Updated: Feb 2013
Pilot	TBD	2011	Operating	**CSS**
Murphy Oil Company Ltd.				
Seal/Cadotte				Updated: Apr 2016
The AER has sent another SIR request on April 19, 2016, and a response is required by May 10, 2016. Oil production for 2016 in western Canada, excluding Syncrude, is expected to average 3,600 barrels. The decrease in oil production in 2016 arises from well declines and selective economic related well shut ins in the Seal area due to lower heavy oil prices.				
Pilot	TBD	TBD	Operating	**HCSS**
Demonstration	12,450	2019	Application	**HCSS**
Northern Alberta Oil Ltd.				
Sawn Lake				Updated: Nov 2015
Parent company Deep Well Oil & Gas says it is waiting on the preliminary results of the Sawn Lake SAGD pilot operated by Andora Energy to fine-tune the horizontal cyclic steam project design. Deep Well is a partner in the Sawn Lake project.				
Pilot	700	TBD	Approved	**HCSS**
Penn West Petroleum Ltd.				
Harmon Valley South				Updated: Jul 2015
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by our partner in the PROP joint venture.				
Pilot	TBD	2014	Operating	**HCSS**
Seal Main				Updated: Mar 2016
The AER is waiting for PennWest to resolve outstanding Statements of Concern filed on the application. The AER has completed its technical review of the application.				
Pilot	75	2011	Operating	**HCSS**
Commercial	10,000	TBD	Application	**HCSS**
Royal Dutch Shell plc				
Peace River				Updated: Jan 2016
Shell has stopped construction of the Carmon Creek project. Shell is retaining the project leases and some equipment as evaluations are ongoing.				
Cadotte Lake	12,500	1986	Operating	**CSS**
Carmon Creek - Phase 1	40,000	TBD	On Hold	**VSD**
Carmon Creek - Phase 2	40,000	TBD	On Hold	**VSD**
SCCC Petroleum Corporation				
Red Earth				Updated: Jun 2016
SCCC Petroleum received regulatory approval for the pilot phase in July 2015.				
Pilot	440	2009	Approved	**Steam & CO_2**
NORTH ATHABASCA REGION — UPGRADER				
BP p.l.c.				
Terre de Grace				Updated: Nov 2015
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2020.				
Pilot	8,400	TBD	Approved	**ADC USP**
Canadian Natural Resources Limited				
Horizon				Updated: Mar 2016
The start-up of Horizon Phase 2B is targeted for October 2016 and will add 45,000 bbls/d of production capacity. Phase 3 is currently on schedule and budget with start up in Q4 2017.				
Phase 1	110,000	2009	Operating	**UPG**
Reliability - Tranche 2	5,000	2014	Operating	**UPG**
Phase 2A	12,000	2014	Operating	**UPG**
Phase 2B	45,000	2016	Construction	**UPG**
Phase 3	80,000	2017	Construction	**UPG**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
E-T Energy Ltd.				
Poplar Creek				Updated: Feb 2016
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	TBD	TBD	Announced	**CCC**
Ivanhoe Energy Inc.				
Tamarack				Updated: Apr 2016
Project is cancelled. Suncor has purchased the leases associated with Ivanhoe. FluidOil Ltd., a London-based company, has purchased the HTL technology and the San Antonio, Texas testing facility.				
Phase 1	34,784	TBD	Cancelled	**HTL**
Suncor Energy Inc.				
Base Operations				Updated: Feb 2016
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
U1 and U2	225,000	1967	Operating	**UPG**
Millennium Vacuum Unit	35,000	2005	Operating	**UPG**
Millennium Coker Unit	97,000	2008	Operating	**UPG**
Syncrude Canada Ltd.				
Mildred Lake/Aurora				Updated: Apr 2016
In December, Syncrude performed coker maintenance originally scheduled for mid 2016. Suncor is the process of purchasing Murphy Oil Corporations 5 per cent stake in Syncrude, upon closing Suncor will own 53.74 per cent of Syncrude. On Feb. 12, 2016, the company submitted supplemental information to the AER for the mine extension project, which is under review.				
Base Plant Stage 1 & 2 Debottlenecking	250,000	1978	Operating	**UPG**
Stage 3 Expansion (UE-1)	100,000	2006	Operating	**UPG**
Stage 3 Debottlenecking	75,000	TBD	Announced	**UPG**
SOUTH ATHABASCA REGION — UPGRADER				
CNOOC Limited				
Long Lake				Updated: Jun 2016
Phase 1	58,500	2009	Operating	**OrCrude**
Value Creation Inc.				
Advanced TriStar				Updated: Apr 2016
Alberta Environmental Assessment Agency has deemed the Environmental Impact Assessment report compete for the ATS project. The review took 165 weeks.				
ATS-1	60,000	TBD	Application	**ATS USP**
ATS 2	60,000	TBD	Application	**ATS USP**
DOEx (Demonstration of Excellence)				Updated: May 2014
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	12,000	2018	Application	**ATS USP**
INDUSTRIAL HEARTLAND REGION — UPGRADER				
North West Upgrading Inc.				
Redwater Upgrader				Updated: Apr 2016
As the result of an on-site pedestrian-vehicle incident Dec. 9, 2015, one of NWR's employees was fatally injured. The on-site workforce has reached 3,800 people. To date, approximately 400 modules have been installed with more than 600 additional modules standing in various stages of assembly at module fabrication shops. Module delivery and assembly into the refinery will continue throughout 2016. Targeted completion in Q4 2017.				
Phase 1	50,000	2017	Construction	**UPG**
Phase 2	50,000	TBD	Approved	**UPG**
Phase 3	50,000	TBD	Approved	**UPG**
Shell Albian Sands				
Scotford Upgrader				Updated: Sep 2015
Shell has made a final investment decision on the HCU debottlenecking project, which is expected to increase hydrocracking capacity by about 20 per cent. Project partner Marathon Oil says that planned turnarounds at the base upgrader and Muskeg River mine were completed on time and on budget in Q2, as well as unplanned downtime at the expansion upgrader.				
Commercial	155,000	2003	Operating	**UPG**
Expansion	100,000	2011	Operating	**UPG**
Scotford HCU Debottlenecking	14,000	TBD	Announced	**UPG**

GLOSSARY of oil sands terms

ASPHALTENES
The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

BARREL
The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

BITUMEN
Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

COGENERATION
The simultaneous production of electricity and steam, which is part of the operations of many oil sands projects.

COKING
An upgrading/refining process used to convert the heaviest fraction of bitumen into lighter hydrocarbons by rejecting carbon as coke. Coking can be either delayed coking (semi-batch) or fluid coking (continuous).

CONDENSATE
Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

CONVENTIONAL CRUDE OIL
Mixture of mainly pentane and heavier hydrocarbons recoverable at a well from an underground reservoir, and liquid at atmospheric pressure and temperature. Unlike bitumen, it flows through a well without stimulation and through a pipeline without processing or dilution.

CRACKING
An upgrading/refining process for converting large, heavy molecules into smaller ones. Cracking processes include fluid cracking and hydrocracking.

CYCLIC STEAM STIMULATION (CSS)
An in situ production method incorporating cycles of steam injection, steam soaking and oil production. The steam reduces the viscosity of the bitumen and allows it to flow to the production well.

DENSITY
The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to 900 kg/m^3 is considered light-to-medium crude—oil above this density is deemed as heavy oil or bitumen.

DILBIT
Bitumen that has been reduced in viscosity through addition of a diluent such as condensate or naphtha.

DILUENT
A light hydrocarbon blended with bitumen to enable pipeline transport. See Condensate.

EXTRACTION
A process, unique to the oil sands industry, that separates the bitumen from the oil sand using hot water, steam and caustic soda.

FROTH TREATMENT
The means to recover bitumen from the mixture of water, bitumen and solids "froth" produced in hot-water extraction (in mining-based recovery).

GASIFICATION
A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy by-products.

GROUNDWATER
Water accumulations below the Earth's surface that supply fresh water to wells and springs.

HEAVY CRUDE OIL
Oil with a gravity below 22 degrees API. Heavy crudes must be blended or mixed with condensate to be shipped by pipeline.

HYDROCRACKING
Refining process for reducing heavy hydrocarbons into lighter fractions, using hydrogen and a catalyst; can also be used in upgrading bitumen.

HYDROTRANSPORT
A slurry process that transports water and oil sand through a pipeline to primary separation vessels located in an extraction plant.

HYDROTREATER
An upgrading/refining process unit that reduces sulphur and nitrogen levels in crude oil fractions by catalytic addition of hydrogen.

IN SITU
A Latin phrase meaning "in its original place." In situ recovery refers to various drilling-based methods used to recover deeply buried bitumen deposits.

IN SITU COMBUSTION
An enhanced oil recovery method that works by generating combustion gases (primarily CO and CO_2) downhole, which then "push" the oil towards the recovery well.

LEASE
A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

LIGHT CRUDE OIL
Liquid petroleum with a gravity of 28 degrees API or higher. A high-quality light crude oil might have a gravity of about 40 degrees API. Upgraded crude oils from the oil sands run around 30-33 degrees API (compared to 32-34 for Light Arab and 37-40 for West Texas Intermediate).

MATURE FINE TAILINGS
A gel-like material resulting from the processing of clay fines contained within the oil sands.

OIL SANDS
Bitumen-soaked sand deposits located in three geographic regions of Alberta: Athabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total in-place deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

OVERBURDEN
A layer of sand, gravel and shale between the surface and the underlying oil sand in the mineable oil sands region that must be removed before oil sands can be mined.

PERMEABILITY
The capacity of a substance (such as rock) to transmit a fluid, such as crude oil, natural gas or water. The degree of permeability depends on the number, size and shape of the pores and/or fractures in the rock and their interconnections. It is measured by the time it takes a fluid of standard viscosity to move a given distance. The unit of permeability is the Darcy.

PETROLEUM COKE
Solid, black hydrocarbon that is left as a residue after the more valuable hydrocarbons have been removed from the bitumen by heating the bitumen to high temperatures.

PRIMARY PRODUCTION
An in situ recovery method that uses natural reservoir energy (such as gas drive, water drive and gravity drainage) to displace hydrocarbons from the reservoir into the wellbore and up to the surface. Primary production uses an artificial lift system in order to reduce the bottomhole pressure or increase the differential pressure to sustain hydrocarbon recovery, since reservoir pressure decreases with production.

RECLAMATION
Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

STEAM ASSISTED GRAVITY DRAINAGE (SAGD)
An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

SURFACE MINING
Operations to recover oil sands by open-pit mining using trucks and shovels. Less than 20 per cent of Alberta's oil sands resources are located close enough to the surface (within 75 metres) for mining to be economic.

SYNTHETIC CRUDE OIL
A manufactured crude oil comprised of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

TAILINGS
A combination of water, sand, silt and fine clay particles that is a by-product of removing the bitumen from the oil sand through the extraction process.

TAILINGS SETTLING BASIN
The primary purpose of the tailings settling basin is to serve as a process vessel, allowing time for tailings water to clarify and silt and clay particles to settle so that the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

THERMAL RECOVERY
Any in situ process where heat energy (generally steam) is used to reduce the viscosity of bitumen to facilitate recovery.

UPGRADING
The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

VISCOSITY
The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.

OIL SANDS CONTACTS

OIL SANDS PRODUCERS

Athabasca Oil Corporation www.athx.com
Baytex Energy www.baytex.ab.ca
BlackPearl Resources www.blackpearlresources.ca
Brion Energy Corporation www.brionenergy.com
Canadian Natural Resources www.cnrl.com
Cenovus Energy www.cenovus.com
Chevron Canada www.chevron.ca
CNOOC Limited www.cnoocltd.com
Connacher Oil and Gas www.connacheroil.com
ConocoPhillips Canada www.conocophillips.ca
Devon Canada www.dvn.com
Enerplus Resources Fund www.enerplus.com
E-T Energy www.e-tenergy.com
Grizzly Oil Sands www.grizzlyoilsands.com
Harvest Operations Corp. www.harvestenergy.ca
Husky Energy www.huskyenergy.ca
Imperial Oil www.imperialoil.ca
Japan Canada Oil Sands www.jacos.com
Koch Exploration Canada www.kochexploration.ca
Korea National Oil Corporation www.knoc.co.kr
Laricina Energy www.laricinaenergy.com
Marathon Oil www.marathon.com
MEG Energy www.megenergy.com
Nexen www.nexeninc.com
North West Upgrading www.northwestupgrading.com
N-Solv www.n-solv.com
Oak Point Energy www.oakpointenergy.ca
Occidental Petroleum Corporation www.oxy.com
Osum Oil Sands www.osumcorp.com
Pan Orient Energy www.panorient.ca
Paramount Resources Ltd. www.paramountres.com
Pengrowth Energy Corporation www.pengrowth.com
PetroChina www.petrochina.com.cn/ptr
PTT Exploration and Production www.pttep.com
Shell Canada www.shell.ca
Sinopec www.sinopecgroup.com/group/en
Statoil Canada www.statoil.com
Suncor Energy www.suncor.com
Sunshine Oilsands www.sunshineoilsands.com
Syncrude www.syncrude.ca
Teck Resources www.teck.com
Total E&P Canada www.total-ep-canada.com
Touchstone Exploration www.touchstoneexploration.com
Value Creation Group www.vctek.com

ASSOCIATIONS/ORGANIZATIONS

Alberta Chamber of Resources www.acr-alberta.com
Alberta Chambers of Commerce www.abchamber.ca
Alberta Energy www.energy.gov.ab.ca
Alberta Energy Regulator www.aer.ca
Alberta Environment and Parks www.aep.alberta.ca
Alberta Innovates www.albertainnovates.ca
Alberta Innovation and Advanced Education www.eae.alberta.ca
Alberta's Industrial Heartland Association www.industrialheartland.com
Building Trades of Alberta www.bta.ca
Canada's Oil Sands Innovation Alliance www.cosia.ca
Canadian Association of Geophysical Contractors www.cagc.ca
Canadian Association of Petroleum Producers www.capp.ca
Canadian Heavy Oil Association www.choa.ab.ca
In Situ Oil Sands Alliance www.iosa.ca
Lakeland Industry & Community Association www.lica.ca
Natural Resources Conservation Board www.nrcb.ca
Oil Sands Community Alliance www.oscaalberta.ca
Oil Sands Secretariat www.energy.alberta.ca
Petroleum Technology Alliance Canada www.ptac.org

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